# ModSAF & Friends

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**8/7/96**

# ModSAF

- **Populates the stage for virtual battlefield simulation**
- **A repository for virtual simulation**
  - **Simulation, PVD, Network Interface, Terrain, Stealth, Logger**
- **Lies on the border of virtual and constructive simulation**
- **Some statistics**
  - **Development started: Spring 92**
  - **Last released version: ModSAF 2.1, May 96**
  - **Current size (July 96)**
    - **Files    483**
    - **Code   852K lines (source only)**
    - **Data   535K lines**
    - **Doc     275K lines**

# Federates

- **Siblings**
  - **ModSAF (Army, Air Force, Synthetic Environment, OPFOR)**
  - **Navy SAF (Navy, Synthetic Environment, OPFOR)**
  - **Marine SAF (Marines, Synthetic Environment, OPFOR)**
- **In-Laws**
  - **Soar (Rotary and Fixed Wing Pilots)**
  - **Commander Forces (Army Ground, Army Aviation, Marine, Air Force)**
  - **BBS**
  - **Eagle**

# Simulation Requirements

- **Training**
  - **SIMNET, SIMITAR, ARMY STOW, DARPA STOW, Force XXI TP**

- **Analysis**
  - **A2ATD, JPSD, JCOS**

- **Acquisition**

- **Military Functions**
  - **Combat: Dismounted, Armored Vehicle, RWA, FWA, Littoral, Blue Water**
  - **C3 and Intel**
  - **Combat Support: Artillery, CAS, Engineers, Air Defense**
  - **Combat Service Support: Transportation and Supply, Repair, Recovery, Medical Evacuation**

# Mission

- **Conventional warfare moving toward MOUT**
- **ModSAF provides commands for**
  - **Individuals**
  - **Platoons**
  - **Companies**

  **Higher level commands generate individual commands**
- **Command Forces generate orders for companies and battalions. These commanders generate orders for platoons and battalions respectively.**

# Unit State

- **ModSAF maintains own state by simulating individual vehicles and DI entities and the state of their supplies and equipment. This information is rolled up in the unit.**

- **Knowledge of enemy in ModSAF is accumulated through contact with enemy or reports from other units. CFOR can use intelligence reports in planning.**

- **Knowledge of adjacent units is available automatically but has very limited use in ModSAF.**

- **Communications is modeled by radio messages including CSSIL and by PO Messages.**

- **Support for misidentification exists but is not used by behaviors.**

# Physical Environment

- **Terrain**
  - **Enhanced DMA data**
  - **No limitations on resolution - 29 Palms uses 1 meter**
  - **Upgrade to GCS will support world wide coverage**
  - **ICTDB upgrades support multiple elevations and building interiors**
  - **Dynamic terrain and objects in progress (supported by individual route maps, mine detection)**
  - **Cultural targets**

- **Phenomenology Effects**
  - **Time of day, real time gridded weather, smoke, vehicle dust**
  - **Ocean and surf zone**

# Dynamic Behavioral Response

- **Reactions**
  - Actions on contact
  - Terrain obstacles
  - Low level route planning

- **Planning**
  - Finding concealed positions
  - Human commander works with filtered map view and reports
  - BBS commanders
  - CFOR automated commanders

# Architecture

- **ModSAF is primarily a HITL simulation. The human acts in the role of commander and provides the majority of the tactics and planning. HITL can be applied at all levels.**

- **ModSAF makes a strong separation between user interface and simulation. CFOR makes use of this boundary to build commander simulations that allows higher echelon automation.**

- **ModSAF also separate physical models and behavioral models. SOAR leverages this boundary to allow SOAR agents to control ModSAF entities.**

- **ModSAF is fully distributed with the ability to connect arbitrary numbers of simulations and user interfaces.**

# Architecture

- **All unit behavior is executed through orders to individuals.  Aggregated units are controlled by other simulations.**

- **In a variable resolution simulation, entities are disaggregated when another entity sends out a disaggregation request or a defined high resolution are is encountered.**

- **Unit behavior is simulated using collections of tasks called task frames that spawn subordinate tasks.  Most tasks use finite state machines and code to implement their behaviors.**

# V&V and Data

- **Many physical model implementations are of validated models**
  - – **All weather (COMBIC, LOTRAN, ILUMA)**
  - – **Target acquisition, delivery accuracy, damage**
- **AMSAA review of physical models**
- **TRAC review of behaviors**
- **Configuration control via ARMY CCB**
- **ARMY program to validate ModSAF**
- **Other services are working on validating other STOW SAFs**

# Lessons Learned

- **KISS**
- **Open system**
- **Top down modeling**
- **Physical/Behavioral model separation less important than resolution separation**
- **Less direct manipulation/more simulation**
- **Concentrate on making system SME accessible and modifiable**
- **More emphasis on C3, but remember top down modeling**

# Where to Next?

**More Research on Simulation -  What Can It Really Tell Us?**

- **Interpretation of results**

- **Understanding resolution**

- **Interoperability**

- **Measurement: benchmarking and validation**

- **Predictive simulation**

- **Repositories and reuse**